RESISTOR-CAPACITOR TESTER 83 Y 124

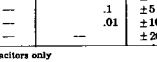
ASSEMBLY MANUAL

knight-kit

CAPACITOR AND RESISTOR COLOR CODE

RESISTOR-MICA CAPACITOR COLOR CODE				
Color	Significant Figures	Multiplier	Tolerance %	Voltage Rating*
Black	0	1	±20*	—
Brown	1	10	±1*	100
Red	2	100	±2*	200
Orange	3	1,000	±3*	300
Yellow	4	10,000	±4*	400
Green	5	100,000	±5*	500
Blue	6	1,000,000	±6*	600
Violet	7	10,000,000	±7*	700
Gray	8	100,000,000	±8*	800
White	9	—	±9*	900
Gold	—	.1	±5	1,000
Silver	—	.01	±10	2,000
None	—	—	±20	500

*Applies to capacitors only

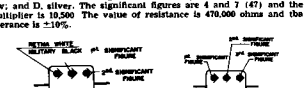


HOW TO DETERMINE THE VALUE OF A RESISTOR

A — First significant figure (digit) of resistance in ohms.
B — Second significant figure.
C — Decimal multiplier (number of zeros to be added).
D — Tolerance of resistor in percent. No color is 20%.

EXAMPLE:

A resistor has the following color bands: A, yellow; B, violet; C, yellow; and D, silver. The significant figures are 4 and 7 (47) and the multiplier is 10,500. The value of resistance is 470,000 ohms and the tolerance is ±10%.

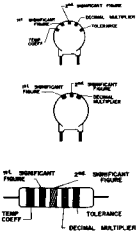


HOW TO DETERMINE THE VALUE OF A MICA CAPACITOR

EXAMPLES:

A capacitor with a 6 dot code (new RETMA standard REC-115A and military MIL-C-5A) has the following markings: Top row, left to right, white, green, brown; bottom row, right to left, brown, red, red. The first color white indicates mica. The significant figures are 5 and 1 (51), and the decimal multiplier is 10. So the capacitance is 510 $\mu\mu f$. Tolerance is ±2%. For most general applications the characteristic can be ignored.

A capacitor with a 6 dot code has the following markings: Top row, left to right, brown, orange, red; bottom row, right to left, brown, red, green. Since the first dot is neither black or white, this is the obsolete RETMA code. The significant figures are 1, 3, and 2 (132), and the decimal multiplier is 10. So the capacitance is 1320 $\mu\mu f$. Tolerance is ±2%. Voltage rating is 500 V DC.



CERAMIC CAPACITOR COLOR CODE					
			Tolerance		
Color	Significant Figures	Decimal Figures	10 $\mu\mu f$ or less ($\mu\mu f$)	Over 10 $\mu\mu f$ (%)	Temp. Coef. (Parts per million per °C.)
Black	0	1	±2.0	±20	0
Brown	1	10	±0.1	±1	−33
Red	2	100	—	±2	−75
Orange	3	1,000	—	±2.5	−150
Yellow	4	10,000	—	—	−220
Green	5	—	±0.5	±5	−330
Blue	6	—	—	—	−470
Violet	7	—	—	—	−750
Gray	8	0.01	±0.25	—	+150 to −1500
White	9	0.1	±1.0	±10	+100 to −750
Gold	—	—	—	—	—

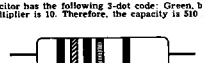
HOW TO DETERMINE THE VALUE OF A CERAMIC CAPACITOR

EXAMPLES:

A ceramic tubular capacitor has the following color bands: Black, red, red, red, green. The significant figures are 2 and 2 (22), and the decimal multiplier is 100. The capacitance is, therefore, 2200 $\mu\mu f$. Tolerance is ±5%. Temperature coefficient is 0. Voltage rating is always 500 V.

A ceramic disc capacitor has the following 5-dot code: Red, brown, green, red, green. The significant figures are 1 and 5 (15), and the decimal multiplier is 100. The capacitance is, therefore, 1500 $\mu\mu f$. The tolerance is ±5%. The temperature coefficients — 75. Voltage rating is always 500 V.

A ceramic disc capacitor has the following 3-dot code: Green, brown, brown. The significant figures are 5 and 1 (51), and the decimal multiplier is 10. Therefore, the capacity is 510 $\mu\mu f$. Voltage rating is always 500 V and the tolerance is always — 0.



HOW TO DETERMINE THE VALUE OF A PAPER TUBULAR CAPACITOR

A — First significant figure (digit) of capacitance in μf.

B — Second significant figure.

C — Decimal multiplier (number of zeroes to be added).

D — Tolerance of capacitor in percent.

E — Voltage rating.

EXAMPLE:

A paper tubular capacitor has the following color bands: A, brown; B, green; C, orange; D, black; and E, yellow. The significant figures are 1 and 5 (15) and the decimal multiplier is 1,500. The value of capacitance is 15,500 $\mu\mu f$. The tolerance is ±20%. The voltage rating is 400 V DC.

TUBULAR PAPER CAPACITOR COLOR CODE				
Color	Significant Figures	Decimal Multiplier	Tolerance %	Voltage Rating (v d-c)
Black	0	1	±20	—
Brown	1	10	—	100
Red	2	100	—	200
Orange	3	1,000	±30	300
Yellow	4	10,000	—	400
Green	5	—	—	500
Blue	6	—	—	600
Violet	7	—	—	700
Gray	8	—	—	800
White	9	—	—	900
Gold	—	—	—	1,000
Silver	—	—	±10	—

SPECIFICATIONS

Resistance Ranges.....R×1—100 to 50,000 ohms
R×100—10K to 5 Megohms

Capacity Ranges.....C1—.00001 to .005 MFD
C2—.001 to .5 MFD
C3—.1 to 50 MFD
C4—20 to 1,000 MFD

Leakage Test Voltages.... 50 volts DC
150 volts DC
250 volts DC
350 volts DC
450 volts DC

Circuit.....AC-operated bridge. Maximum shadow on "magic eye" tube indicates bridge balance.

Power Supply.....Transformer operated half-wave rectifier.

Tube Complement.....6X4 rectifier
6E5 balance indicator

Operating Power.....105 to 125 volts AC, 50 or 60 cycles ONLY.

The KNIGHT R/C Tester is an extremely versatile, highly accurate instrument. It measures resistances from 100 ohms to 5 megohms, and capacitances from 10 micromicrofarads to 1,000 microfarads, with an accuracy of ±10% by means of an AC-operated bridge. In order to exactly determine the capacity of electrolytics, a variable resistance is included in the known leg of the bridge circuit to balance out the internal resistance of the capacitor. This variable resistor, known as the POWER FACTOR control, provides a direct-reading indication of the electrolytic's efficiency.

In addition, this equipment indicates whether a capacitor is shorted or open. Leakage current of electrolytic capacitors is determined by actually applying an appropriate operating potential, up to 450 volts, to the capacitor. Therefore the leakage test is a true indication of the condition of the tested component.

CHECKING YOUR KIT

Before starting to build your KNIGHT R/C Tester, check each piece in the kit against the Parts List on page 19. If you cannot identify some of the parts by sight, locate them on the various pictorial diagrams. Capacitor and resistor values, if not printed on the part, can be found with the aid of the color code chart.

CONSTRUCTION HINTS

You will need the following tools to construct your KNIGHT R/C Tester; a pair of long nose pliers, a pair of diagonal cutters, a medium size screwdriver, a set-screwdriver, and a 40 watt soldering iron. Another tool which is handy, but not absolutely essential, is a ¼" hex nut driver. These tools can be ordered from Allied. Their stock numbers and prices are at the end of the Parts List.

The step-by-step instructioas were prepared by a skilled technician while he was actually building the KNIGHT R/C Tester. Follow the instructions carefully for the best and fastest way to assemble this unit. We suggest that you read through the instructions before building the R/C Tester. This will enable you to familiarize yourself with the procedure and avoid possible errors. We invite you to use the blank parentheses, ( ), before each step to check off the step after you have completed it.

Each step is clearly illustrated on an accompanying line drawing. Some builders prefer to "cross out" each wire and component on the drawings with a colored pencil after it is installed. This is an excellent way to avoid mistakes, and highly recommended by us. For this reason each wiring figure is duplicated on a separate, folded sheet of paper.

You are now ready to build your KNIGHT R/C Tester.

MOUNTING THE PARTS ON THE CHASSIS.

REFER TO FIGURE 1.

(✓) Mount one of the small rubber grommets in the hole near the left rear edge of the chassis.

(✓) Mount the other small grommet in the hole in the rear of the chassis.

(✓) Mount a large grommet in each of the two holes behind the rectangular cutout in the chassis.

(✓) Mount a solder lug in front of the grommet on the left side of the chassis with a machine screw and nut. This solder lug will be referred to as the Left Hand Solder Lug.

(✓) Mount the Power Transformer (T-1) behind the rectangular cutout on the outside of the chassis. Position T-1 so its red, red-green, and black leads are toward the rear of the chassis. Mount the five-terminal strip (TS-1) in the position shown on the inside of the chassis under the left transformer mounting nut. Mount a three-terminal strip (TS-2) in the position shown under the right mount-

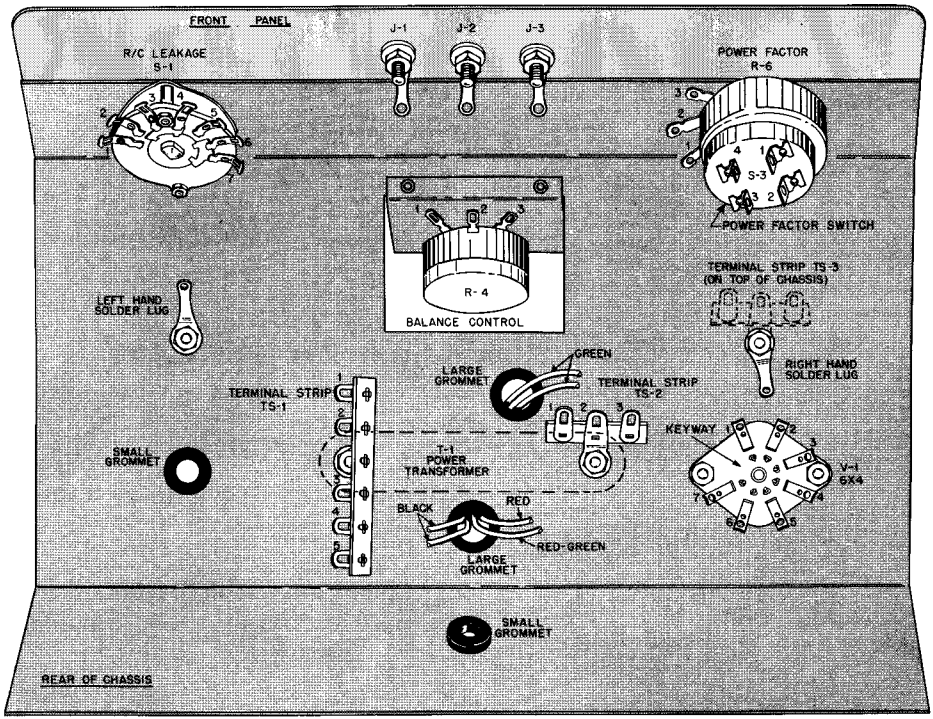


FIGURE 1. MOUNTING THE PARTS ON THE CHASSIS

ing nut. Push the red, red-green, and black leads through the large grommet near the rear of the chassis. Push the green leads through the other large grommet.

(X) Mount the 7-pin wafer socket inside the chassis over the hole near the right rear edge of the chassis with two machine screws and nuts. The keyway (the wide open space between two of the socket pins) must be toward the left and front of the chassis.

(X) In front of the 7-pin socket, mount the other three-terminal strip (TS-3) on the outside of the chassis, shown in broken lines in Figure 1, and a solder lug on the inside of the chassis, with a machine screw and nut. This solder lug will be referred to as the Right Hand Solder Lug.

(X) Mount R-4, the 10K ohm potentiometer without a switch, on the bracket that is welded to the top of the chassis so its terminals point toward the rectangular hole in the chassis. Figure 2 shows how to mount a control using two nuts and a lockwasher

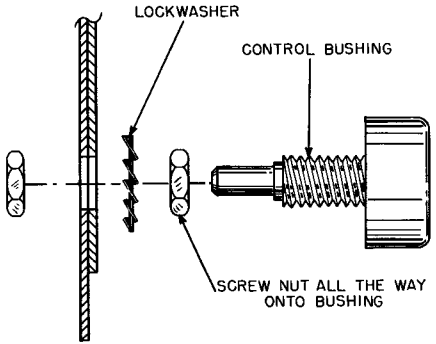


FIGURE 2. HOW TO MOUNT A CONTROL

(X) Mount the front panel to the chassis with R-6, the 800 ohm potentiometer with a switch. See Figure 3. The potentiometer terminals must be toward the center of the chassis, as shown in Figure 1.

(X) Mount S-1, the single-wafer switch, in the left hand hole in the front of the chassis. Position the switch as shown in Figure 1. See Figure 3.

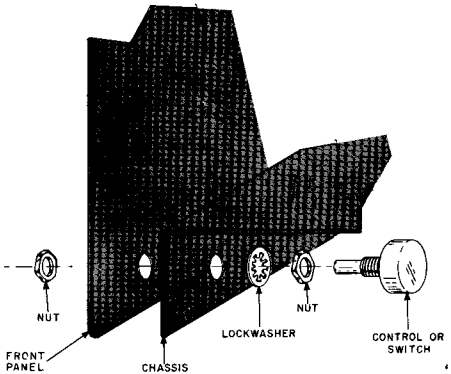


FIGURE 3. HOW TO MOUNT THE FRONT PANEL WITH A CONTROL

(X) Mount the three binding posts in the three holes at the bottom of the front panel. Position the binding post holes up and down. The red binding post (J-2) must be in the center hole. The black binding posts (J-1 and J-3) must be on either side of J-2. Figure 4 shows how to mount a binding post using a shouldered (extruded) fiber washer, three flat fiber washers, a solder lug, and a nut.

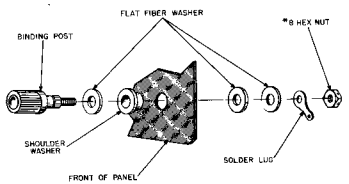


FIGURE 4. HOW TO MOUNT A BINDING POST

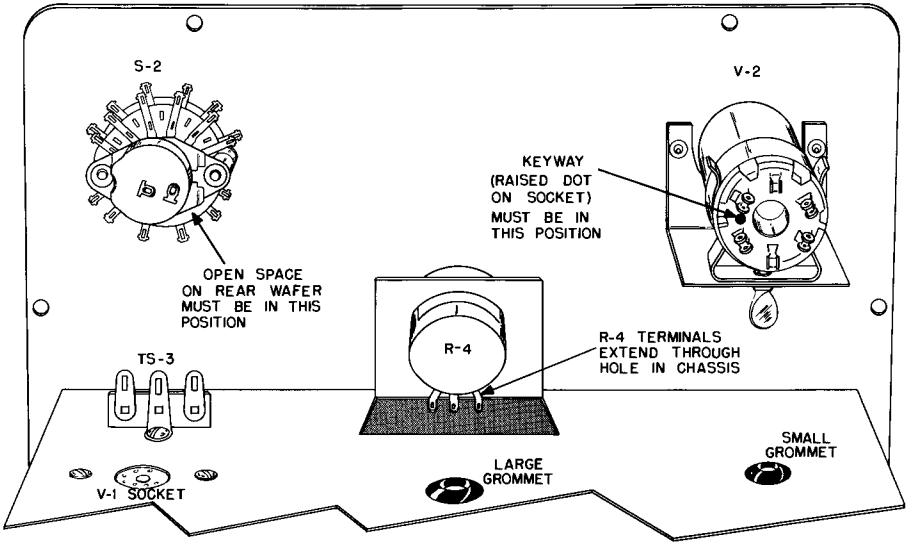


FIGURE 5. HOW TO MOUNT THE PARTS ON THE FRONT PANEL

REFER TO FIGURE 5.

( ) Mount the double-wafer switch (S-2) in the small hole near the top of the front panel. See Figure 2. The open space on the rear wafer must be toward R-4, as shown in Figure 1.

( ) Figure 6 shows how to mount the 6E5 (V-2). Place the socket on the 6E5 and mount it behind the large hole in the front panel. Do not tighten the bracket mounting screws too much or the escutcheon will bend. Notice that there is a small raised dot between two of the pins on the bottom of the socket. This is the keyway. Rotate the 6E5 so that the keyway is toward the center of the front panel.

You are now ready to begin wiring the KNIGHT R/C Tester. Before doing so, we suggest that you review the following Wiring and Soldering Hints.

How well a piece of electronic equipment works often depends on the quality of workmanship used in its construction. It is for this reason that the following suggestions are made.

The insulated wire furnished with this kit is cut to length and the ends are stripped, thus saving the builder this tedious task. The color of each piece of wire indicates its length. It is important to use the color spacified in each of the wiring steps.

A piece of bare wire is included. Whenever it is necessary to use some of it, the exact length of the piece required is given.

The flexible tubing supplied is called "spaghetti". Spaghetti is used to cover the bare end leads of some of the components and portions of some of the bare wires when there is a possibility they will touch other bare wires or the chassis.

The proper way to connect a wire or lead to a solder terminal is shown in Figure 7. To insure a good mechanical connection, squeeze the wire against the terminal with your long nose pliers after it has been hooked on. Make sure the wires, leads, and terminals are clean before connecting them. If necessary, scrapa them with a pocket knife until any foreign substance, such as wax, is removed. Be extremely careful not to nick the wire with the knife, or it may break when it is bent.

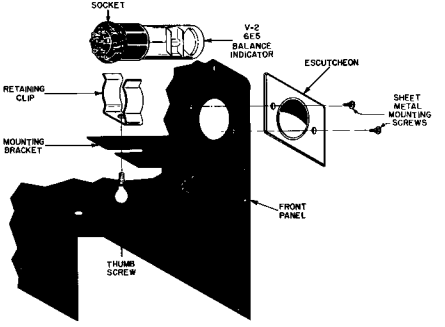


FIGURE 6. MOUNTING THE 6E5 (V-2)

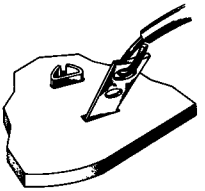


FIGURE 7. HOW TO CONNECT A WIRE TO A TERMINAL

Unless otherwise stated, all the leads on the reeistors, capacitors, transformers, chokes, etc., should be as short as poseible. Figure 8 illustrates the best way to connect a component. As shown, the end leads should be pulled through the terminals so that the parts are tightly mounted. After a lead is pulled through a terminal, bend it around the terminal and cut off the excses wire.

A sufficient amount of rosin core solder is furnished to completely assemble your R/C Tester. However, if you prefer to use your own,

USE ONLY ROSIN CORE SOLDER.

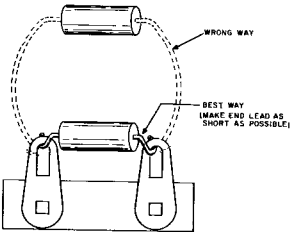


FIGURE 8. BEST WAY TO CONNECT A COMPONENT

IF YOU ARE IN DOUBT ABOUT THE SOLDER YOU MAY ALREADY HAVE, WE STRONGLY RECOMMEND THAT YOU OBTAIN A NEW ROLL PLAINLY MARKED: "ROSIN CORE SOLDER." KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX WILL CORRODE AND WILL NOT WORK LONG, AND ARE NOT ELIGIBLE FOR REPAIR OR SERVICE.

Before soldering, the tip of your soldering iron must be properly tinned. To do this, clean the surfaces of the tip with steel wool, or a fine file, until the bright copper surface is exposed. Plug the iron in and allow it to heat until it melts solder. Apply solder to the tip until it is well covered with a thin coat. Wipe off the excess solder with a rag. The tip should now be "shiny". Re-tin the tip whenever it becomes covered with scale (flakes of gray matter).

WHEN A PARTICULAR STEP SAYS "CONNECT", DO NOT SOLDER THE CONNECTION. ONLY SOLDER WHEN THE WORD "SOLDER" APPEARS.

Prior to soldering a connection be sure the iron is hot enough to melt solder. Preheat the CONNECTION by holding the tip of the iron against the joint to be soldered. After it is heated, apply solder to the joint, NOT to the iron tip. Use only enough solder to fill the crevices between the wires, leads, and terminal.

After you have soldered a counection, push any insulation or spaghetti on the wires or leads as close to the joint as possible. This will prevent close connections from touching one another and causing a short.

You are now ready to begin wiring your KNIGHT R/C Tester. As you are wiring, we would like you to keep the follqwing in mind: Place all long wires close to the chassis, do your best to position the parts as shown in the wiring diagrams, solder only when told to do so, and, above all, USE ONLY ROSIN CORE SOLDER.

WIRING THE SOCKET OF V-2

NOTE: In this manual, the word "CONNECT" is used to designate when a wire or lead is to be connected, but NOT soldered, to a terminal. The word "SOLDER" means that all of the wires connected to a terminal are to be soldered. SOLDER ONLY WHEN THE STEP SAYS SOLDER.

REFER TO FIGURE 9.

(✓) Solder one end of R-2, the 1 megohm resistor with the brown, black, and green color bands, to pin 2 of V-2. Connect the other end to pin 4 of V-2.

(✓) Solder one end of the white-brown wire to pin 4 of V-2. The other end will be connected later.

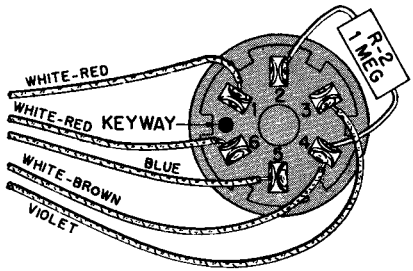


FIGURE 9. WIRING THE SOCKET OF V-2

(✓) Solder one end of a violet wire to pin 3 of V-2. The other end will be connected later.

(✓) Solder one end of a blue wire to pin 5 of V-2. The other end will be connected later.

(✓) Solder one end of a white-red wire to pin 6 of V-2. The other end will be connected later.

(✓) Solder one end of the other white-red wire to pin 1 of V-2. The other end will be connected later.

(✓) Pass the free ends of all the wires on the socket of V-2 through the grommet directly below V-2 so they can be connected inside the chassis.

WIRING SWITCH S-2

REFER TO FIGURE 10.

(✓) Solder one end of C-6, the 200 MMFD (.0002 MFD) mica capacitor, to terminal 10 on the front wafer of S-2 (the wafer closest to the front panel). Connect the other end to terminal 3 of TS-3.

(✓) Solder one end of R-7, the resistor with 200K printed on its body, to terminal 11 on the front wafer of S-2. Connect the other end to terminal 1 of TS-3.

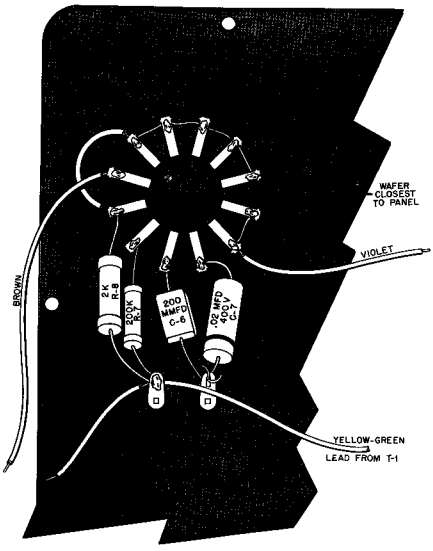


FIGURE 10. WIRING THE FRONT WAFER OF SWITCH S-2

- Connect one end of R-8, marked 2K, to terminal 12 on the front wafer of S-2. Connect the other end to terminal 1 of TS-3.
- Connect the yellow-green lead on T-1 to terminal 1 of TS-3.
- Solder a yellow wire to terminal 1 of TS-3. The other end will be connected later.
- Connect the black banded end of C-7, .02 MFD 400 V, to terminal 3 of TS-3. Solder the other end to terminal 9 on the front wafer of S-2.
- Pass one end of a violet wire through terminal 8 and connect it to terminal 7 on the front wafer of S-2. Solder both terminals. The other end will be connected later.
- Connect terminals 6, 5, 4, 3, 2, and 12 on the front wafer together by stringing a 4" piece of bare wire through them. Place 3/4" of spaghetti on the portion of the bare wire between terminals 2 and 12. Solder all the terminals.
- Solder one end of a brown wire to terminal 1 on the front wafer of S-2. The other end will be connected later.

REFER TO FIGURE 11.

- Solder the yellow wire on T-1 to terminal 20 on the rear wafer of S-2.
- Solder one end of an orange wire to terminal 21 on the rear wafer of S-2. Connect the other end to terminal 3 of TS-3.
- Solder one end of a green wire to terminal 3 of TS-3. The other end will be connected later.
- Connect one end of an orange wire to terminal 19 on the rear wafer of S-2. Solder the other end to terminal 2 of TS-3.
- Solder one end of a blue wire to terminal 22 on the rear wafer of S-2. The other end will be connected later.
- Solder one end of a white wire to terminal 13 on the rear wafer of S-2. The other end will be connected later.
- Connect one end of a violet wire to terminal 23 on the rear wafer of S-2. The other end will be connected later.
- Connect one end of R-12, 22K ohms (red, red, orange), to terminal 23 on the rear wafer of S-2. Solder the other end to terminal 14 on

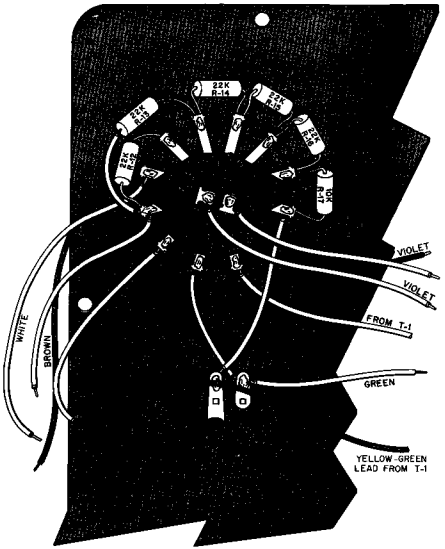


FIGURE 11. WIRING THE REAR WAFER OF SWITCH S-2

the rear wafer of S-2.

(✓) Place ¾" spaghetti over one end of R-13, 22K ohms (red, red, orange). Solder this end to terminal 23 on the rear wafer of S-2. Connect the other end to terminal 15 on the rear wafer of S-2.

(✓) Solder one end of R-14, 22K ohms (red, red, orange), to terminal 15 on the rear wafer of S-2. Connect the other end to terminal 16 on the rear wafer of S-2.

(✓) Solder one end of R-15, 22K ohms (red, red, orange), to terminal 16 on the rear wafer of S-2. Connect the other end to terminal 17 on the rear wafer of S-2.

(✓) Solder one end of R-16, 22K ohms (red, red, orange), to terminal 17 on the rear wafer of S-2. Connect the other end to terminal 18 on the rear wafer of S-2.

(✓) Solder one end of R-17, 10K ohms (brown, black, orange), to terminal 18 on the rear wafer of S-2. Solder the other end to terminal 19 on the rear wafer of S-2.

(✓) Solder one end of a violet wire to terminal 24 on the rear of S-2. The other end will be connected later.

(✓) Solder one end of another violet wire to terminal 25 on the rear of S-2. The other end will be connected later.

WIRING THE CHASSIS

(✓) Pass the free ends of the yellow wire on terminal 1 of TS-3, the green wire on terminal 3 of TS-3, the blue wire on terminal 22 of S-2, the brown wire on terminal 1 of S-2, the violet wires on terminals 8 and 23 of S-2, and the white wire on terminal 13 of S-2 through the rectangular hole so they can be connected inside the chassis.

(✓) Pass the free ends of the violet wires on terminals 24 and 25 of S-2 through the grommet behind T-1 so they can be connected inside the chassis.

TURN THE CHASSIS OVER. REFER TO FIGURE 12.

(✓) Connect the yellow wire in the rectangular hole to terminal 3 of R-4.

(✓) Connect the green wire in the rectangular hole to J-3.

(✓) Connect the blue wire in the rectangular hole to terminal 1 of R-4.

(✓) Connect the violet wire on terminal 8 of S-2 to terminal 1 of TS-1.

(✓) Connect the other violet wire in the rectangular hole to terminal 1 of TS-2.

(✓) Solder the brown wire in the rectangular hole to terminal 4 of S-1.

(✓) Connect the white wire in the rectangular hole to terminal 2 of S-3.

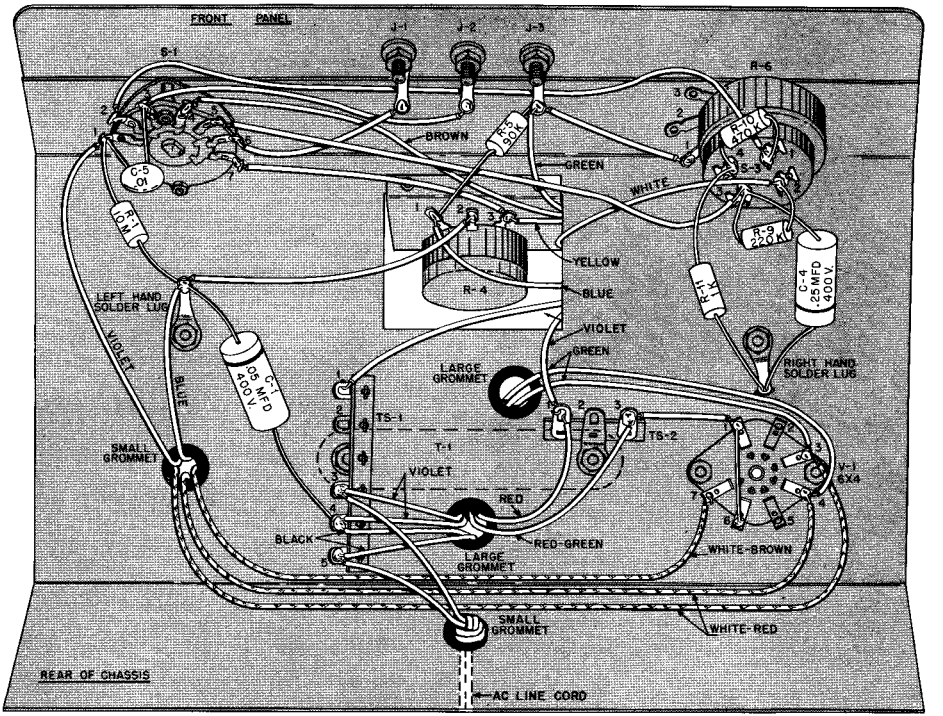


FIGURE 12. FIRST CHASSIS WIRING VIEW

( ) Connect either of the violet wires in the grommet behind T-1 to terminal 3 of TS-1.

( ) Connect the other violet wire in the grommet behind T-1 to terminal 4 of TS-1.

( ) Connect the red lead in the grommet behind T-1 to terminal 1 of TS-2.

( ) Connect the red-green lead in the grommet behind T-1 to terminal 3 of TS-2.

( ) Connect either black lead in the grommet behind T-1 to terminal 4 of TS-1.

( ) Connect the other black lead in the grommet behind T-1 to terminal 5 of TS-1.

( ) Connect either green lead in the grommet in front of T-1 to pin 3 of V-1. **NOTE: The green wires may be enameled. Be sure to scrape the enamel off before connecting them.**

( ) Connect the other green lead in the grommet in front of T-1 to pin 4 of V-1.

( ) Connect the violet wire in the grommet on the left side of the chassis to terminal 1 of S-1.

( ) Connect the blue wire in the grommet on the left side of the chassis to the Left Hand Solder Lug.

( ) Connect the white-brown wire in the grommet on the left side of the chassis to pin 7 of V-1.

( ) Solder either of the white-red wires in the grommet on the left side of the chassis to pin 4 of V-1.

( ) Solder the other white-red wire in the grommet on the left side of the chassis to pin 3 of V-1.

( ) From the outside of the chassis, insert the bare ends of the line cord through the grommet in the rear of the chassis. Tie a knot in the line cord 2" from the bare ends on the inside of the chassis. Solder either of the bare ends of the line cord to terminal 5 of TS-1. Solder the other bare end to terminal 3 of TS-1.

CAUTION: NEVER TOUCH ANY PART OF THE WIRING WHILE THIS INSTRUMENT IS PLUGGED INTO A POWER OUTLET. NEVER USE OR TEST THE R/C TESTER ON OR NEAR A GROUNDED METAL BENCH, RADIATOR, SINK, OR OTHER GROUNDED METAL OBJECT.

( ) Connect the black-banded end of C-1, .05 MFD 400 V, to the Left Hand Solder Lug. Solder the other end to terminal 4 of TS-1.

( ) Connect one end of a green wire to the Left Hand Solder Lug. Solder the other end to terminal 2 of R-4.

( ) Solder one end of R-1, 10 Megohms (brown, black, blue), to the Left Hand Solder Lug. Connect the other end to terminal 1 of S-1.

( ) Solder one end of C-5, .01 MFD 600 V ceramic disc, to terminal 1 of S-1. Connect the other end to terminal 3 of S-1.

( ) Solder one end of a gray wire to terminal 2 of S-1. Connect the other end to terminal 1 of S-3.

( ) Solder one end of a yellow wire to terminal 7 of S-1. Solder the other end to terminal 3 of R-4.

( ) Solder one end of an orange wire to terminal 6 of S-1. Solder the other end to J-1.

( ) Solder one end of a violet wire to terminal 5 of S-1. Connect the other end to terminal 3 of S-3.

( ) Solder one end of R-5, the resistor with 90K printed on its body, to terminal 1 of R-4. Connect the other end to J-3.

( ) Solder one end of an orange wire to J-3. Solder the other end to terminal 1 of R-6.

( ) Solder one end of a green wire to terminal 3 of S-1. Solder the other end to J-2.

( ) Solder one end of R-9, 220K ohms (red, red, yellow), to terminal 2 of S-3. Connect the other end to terminal 3 of S-3.

( ) Connect the black-banded end of C-4, .25 MFD 400 V, to the Right Hand Solder Lug. Solder the other end to terminal 3 of S-3.

( ) Solder one end of R-10, 470K ohms (yellow, violet, yellow), to terminal 1 of S-3. Connect the other end to terminal 4 of S-3.

( ) Solder one end of R-11, 1K ohm (brown, black, red), to terminal 4 of S-3. Connect the other end to the Right Hand Solder Lug.

( ) Solder one end of a 1¼" bare wire to pin 6 of V-1. Connect the other end to pin 1 of V-1.

( ) Solder one end of a red wire to pin 1 of V-1. Solder the other end to terminal 3 of TS-2.

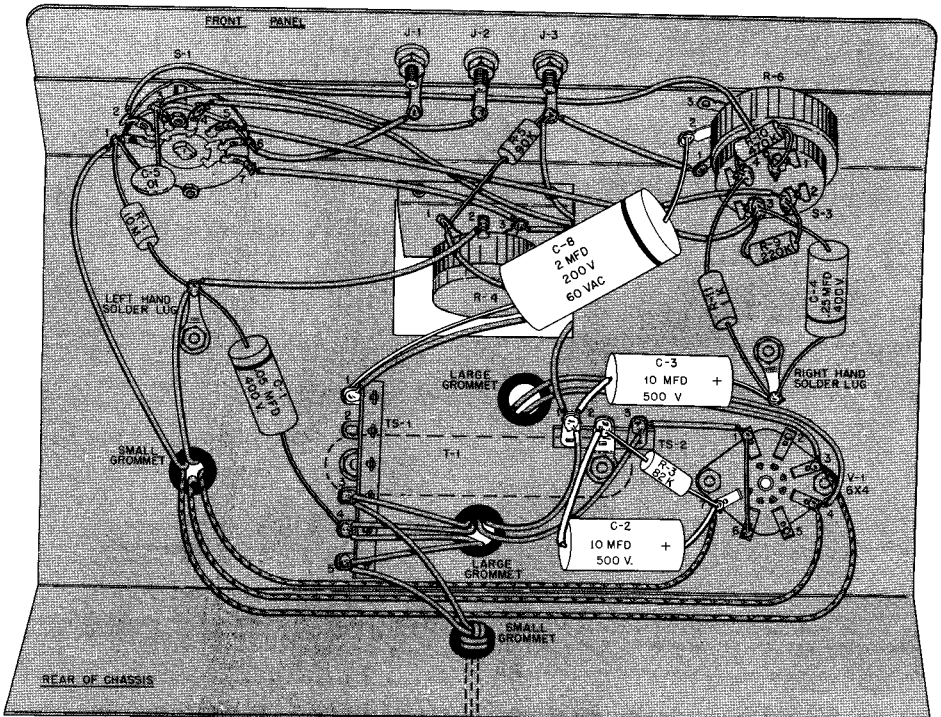


FIGURE 13. SECOND CHASSIS WIRING VIEW

REFER TO FIGURE 13.

(✓) Connect one end of R-3, 82K ohms (gray, red, orange), to pin 7 of V-1. Connect the other end to terminal 2 of TS-2.

(✓) Put a ½" piece of spaghetti on the "+" end of C-2, 10 MFD 500 V, and solder it to pin 7 of V-1. Put a ¾" piece of spaghetti on the other lead of C-2, and solder it to terminal 2 of TS-2.

(✓) Solder the "+" end of C-3, 10 MFD 500 V, to the RIGHT HAND SOLDER LUG. Put a ¾" piece of spaghetti on the other lead of C-3 and solder it to terminal 1 of TS-2.

(✓) Solder the black banded end of C-8, 2 MFD 200 V (60 VAC), to terminal 2 of R-6. Solder the other end to terminal 1 of TS-1.

You have finished wiring your KNIGHT R/C Tester.

(✓) Mount one of the small knobs on the R/C-LEAKAGE SWITCH by tightening the set screw against the flat on the shaft.

(✓) Turn the shaft on the POWER FACTOR control fully counterclockwise until a "click" is heard. Mount another small knob on this shaft so the indicator line points to PAPER-MICA.

(✓) Mount the last small knob on the AC OFF-R/C-LEAKAGE by tightening the set screw against the flat on the shaft.

(✓) Turn the shaft of R-4 fully counterclockwise. Slide the pointer bushing onto the shaft. While holding the shaft in its maximum counterclockwise position, line up the hairline on the pointer with the extreme counterclockwise mark on the scale. Tighten the pointer set screw against the shaft of R-4 from behind the front panel.

CALIBRATION

(✓) Plug V-1 (the 6X4) into its socket.

(✓) Turn the **SELECTOR** switch to AC OFF.

(✓) Plug the R/C Tester into a power outlet.

CAUTION: NEVER TOUCH ANY PART OF THE WIRING WHILE THIS INSTRUMENT IS PLUGGED INTO A POWER OUTLET. NEVER USE OR TEST THE R/C TESTER ON OR NEAR A GROUNDED METAL BENCH, RADIATOR, SINK, OR OTHER GROUNDED METAL OBJECT.

( ) Turn the **POWER FACTOR** control fully counterclockwise until a "click" is heard.

(✓) Connect one end of the 200K calibrating resistor to the red binding post. Connect the other end to the right hand black binding post.

(✓) Turn the **AC OFF-R/C-LEAKAGE** switch to R×100.

( ) Allow the R/C Tester to warm up. Rotate the pointer until the balance indicator (the tuning eye in the upper left hand corner of the front panel) is "open" as far as possible. The pointer should now be lined up with the figure 2000 at the top of the scale. If it is not, loosen the set screw in the pointer bushing and adjust the pointer so it lines up with 2000 when the balance indicator is open. Tighten the pointer set screw.

( ) Turn the **AC OFF-R/C-LEAKAGE** switch to **AC OFF**. Remove the plug from the power outlet.

( ) Mount the large knob on the shaft of R-4.

MOUNTING THE HANDLE TO THE CASE

REFER TO FIGURE 14.

( ) From the top of the case insert the legs of the handle into the two holes in the case.

( ) Place, in order, a flat metal washer, a spring, and another flat metal washer on one of the handle legs. Secure them in place with a cottsrpin.

( ) Do the same to the other leg.

MOUNTING THE R/C TESTER IN THE CASE

( ) From the inside of the case, push the line cord plug through the large round hole in the rear of the case.

( ) Slide the chassis into the case.

( ) Line up the two small holes in the rear of the chassis with the two small holes in the rear of the case. Secure the chassis to the rear of the case by screwing the two long sheet metal screws into the two holes in the chassis.

( ) Line up the small holes around the outside edge of the front panel with the corresponding holes around the front of the case. Screw a short sheet metal screw into each of these holes.

( ) Assemble one red and one black test lead as shown in Figure 15.

You have completed your KNIGHT R/C Tester. We know it will give you many hours of faithful service.

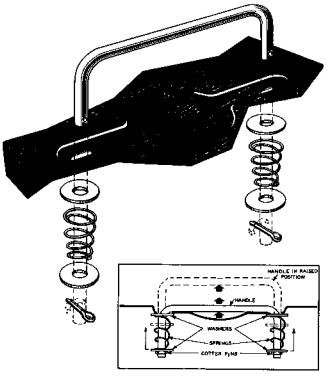


FIGURE 14. HOW TO MOUNT THE HANDLE

HOW TO USE THE R/C TESTER

Binding Posts: The **RED** center post and the **RIGHT HAND BLACK** post (labeled "R") are used for **RESISTANCE** measurements, while the **LEFT HAND BLACK** post (labeled "C") and the center post are used for **CAPACITY** measurements. The **RED** binding post is **POSITIVE** for all measurements; therefore, be sure to connect the + terminal of electrolytic capacitors to this terminal.

Balance Indicator: Maximum shadow on the screen of the 6E5 indicates the bridge circuit is balanced.

BALANCE CONTROL: The control with the pointer directly indicates the resistance, capacity, and/or power factor of the component under test by balancing the AC-operated bridge.

AC OFF-R/C-LEAKAGE Control: Switch the circuits in the R/C Tester so that resistance, capacity, or leakage may be measured.

R/C-LEAKAGE Control: Spring-loaded switch that applies selected test voltage to electrolytic capacitors only as long as the switch is held in the **LEAKAGE** position. Automatically discharges the capacitor under test when released.

POWER FACTOR Control: Balances out the internal resistance of electrolytic capacitors when their capacity is being measured. Indicates directly the power factor of the capacitor under test. When in the **PAPER-MICA** position, this control is out of the circuit.

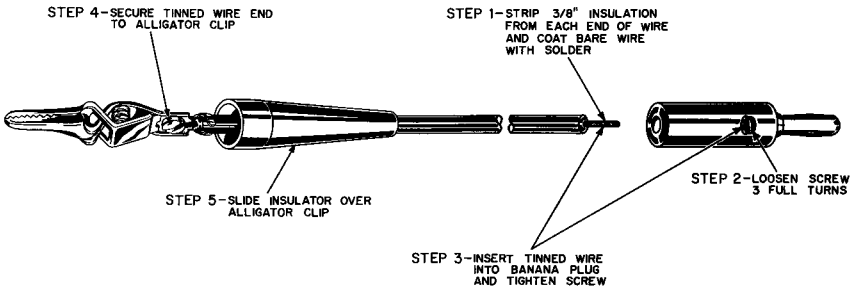


FIGURE 15. HOW TO ASSEMBLE THE TEST LEADS

Resistance Measurements

Coanect the unknown resistor between the **RED** and the **RIGHT HAND BLACK** binding posts (marked "R").

Set the **AC OFF-R/C-LEAKAGE** control at **R×1**. While watching the tuning eye **BALANCE INDICATOR,** rotate the **BALANCE** control throughout its range. When the shadow on the **BALANCE INDICATOR** is maximum, read the resistance directly from the **OUTSIDE** scale around the **BALANCE** control.

If the eye does not open when the **AC OFF-R/C-LEAKAGE** control is set at **R×1**, set it at **R×100**. Adjust the **BALANCE** control for maximum shadow on the **BALANCE INDICATOR**. Multiply the reading on the **OUTSIDE** scale by 100 to determine the value of the unknown resistor.

If the eye still does not open, the unknown resistance is either below 100 ohms or above 5 megohms.

Paper, Mica, and Ceramic Capacity Measurements

Coanect the nnknown capacitor between the **RED** and the **LEFT HAND BLACK** binding posts (marked "C").

NOTE: If the capacitor to be measured is less than .0005 MFD (500 MMFD), it must be connected directly to the binding posts. DO NOT use the test leads to measure these capacitors.

Tura the **POWER FACTOR** control to its extreme counterclockwise position until a "click" is heard.

To determine the condition of the capacitor (i.e., whether it is shorted or open), set the **AC OFF-R/C-LEAKAGE** control at the voltage rating of the capacitor (**50**, 150, 250, 350, or 450 V.). Look at the tuning eye. Then turn the E/C-**LEAKAGE** switch to the **LEAKAGE** position. If the eye suddenly closes, and then rsturns to normal, the capacitor is all right. If there is no shadow, or the lighted area overlaps, the capacitor is shorted. If the eye closes partially the capacitor is leaky, if the eye flutters the capacitor is intermittent. If nothing happens to the eye when the **R**/C-**LEAKAGE** switch is turned to **LEAKAGE**, the capacitor is open.

To measure the capacity of the capacitor, turn the **AC OFF-R/C LEAKAGE** switch to **C1, C2,** or **C3**, whichever is appropriate. The **C1** rsnge covers from **.00001 MFD** to **.005 MFD**, the **C2** range from **.001 MFD** to **.5 MFD**, and the **C3** range from **.1 MFD** to **50 MFD**. Rotate the **BALANCE** control until maximum shadow appears on the **BALANCE INDICATOR**. Read the capacity directly in microfarads on the scale for which the **AC OFF-R/C LEAKAGE** switch is set.

Electrolytic Leakage, Power Factor, and Capacity Measurements

CAUTION: Always connect the "+" (positive) terminal of electrolytic capacitors to the RED binding post and the "—" (negative) terminal to the LEFT HAND BLACK binding post.

Coanect the unknown capacitor to the R/C Tester as directed above.

To measure the capacity of electrolytics, turn the **AC OFF-R/C-LEAKAGE** switch to **C3** or **C4**, whichever is appropriate. **C3** covers from .1 to **50 MFD** and **C4** covers from 20 to 1,000 **MFD**. Turn the **BALANCE** control until the **BALANCE INDICATOR** opens as far as possible. Next, turn the **POWER FACTOE** control until the **BALANCE INDICATOE** showa maximum shadow. Reset the **RALANCE** control for maximum shadow. Read the capacity indicated by the pointer on the **RALANCE** control on either the **C3** or **C4** scale. Read the power factor in percentage directly from the scale around the **POWER FACTOR** control.

If the power factor is 20%, the effective capacity of the tested component is 98% of the measured capacity. Likewise, 30% power factor means the effective capacity is 95% of the measured capacity, while a 50% power factor indicates the capacitor is only 87% efficient.

Shorts and opens are checked in the same manner as for paper, mica, and ceramic capacitors, except the **POWER FACTOR** switch must be **ON**.

Select the proper voltage to be used. Turn the **POWER FACTOE** switch **ON** (it may be set at sero).

Hold the **R/C – LEAKAGE** switch in the **LEAKAGE** position, and observe the **TUNING INDICATOR**. If the eye closes completely and remains closed, the capacitor is defective (shorted). If the eye flickers, the capacitor is intermittent and should be replaced. When the eye closes and then opens (completely or partially) the capacitor is good. The eye may open slowly when testing a large capacity electrolytic due to the incrsased charging time because of the large capacity.

Electrolytic capacitors do not respond to leakage tests because they are manufactured using an electrolyte which conducts current to a limited degree. Therefore, a partial closing of the eye on **LEAKAGE** does not **ALONE** indicate a defective capacitor because an electrolytic is inhersntly "leaky".

CIRCUIT DESCRIPTION

SEE FIGURE 16.

The KNIGHT R/C Tester uses an AC-opernted bridge circuit for all rssistance and capacity measurements. Two "legs" of the bridge are varied by R-4, the 10K ohm BALANCE control.

For capacity measurements, the third leg of the bridge is a known capacitor. When **AC OFF-R/C-LEAKAGE** switch S-2 is in the C1 position, C-6 (200 MMFD) is the third leg. In the C2 position, C-7 (.02 MFD) is the third leg, while for the C3 and C4 positions, C-8 (2 MFD) is the third leg.

Notice that R-6, the 800 ohm POWER FACTOR control is in series with C-8. When this control is in its extreme counter clockwise position and S-2 is in the C3 or C4 position, the left end of C-8 is connected directly to J-3, and R-6 is out of the circuit. In any other position, R-6 is part of the third leg. S-3, on the rear of **R**-6, shorts **R**-9 and R-10 out of the circuit when power factor is being measured.

The fourth leg of the circuit is the unknown capacitor.

For resistance measurements, the third leg of the bridge is R-8 (2K ohms) when S-2 is in the R×1 position. For the R×100 position, R-7 (200K ohms) is the third leg.

The fourth leg is the unknown resistor.

When the bridge circuit is balanced, zero voltage is applied to the deflecting element in V-2 (6E5), causing the electron stream to bombard only a portion of the screen, thus producing the "shadow"

The half wave rectifier circuit built around V-1 (6X4) supplies the high voltage necessary to operate V-2.

AC voltage for the bridge circuit is supplied by a separate winding on power transformer T-1.

The third secondary winding on T-1 supplies 6.3 V AC for the heaters in V-1 and V-2.

The voltage divider across S-2C consisting of R-12, R-13, R-14, R-15, R-16, and R-17 supplies the various DC voltages necessary to test the condition of capacitors.

SERVICE HINTS

If your KNIGHT R/C Tester does not operate properly:

1. Carefully recheck all of the wiring. The most frequent cause of an inoperative kit is incorrect wiring. If possible, also have a friend recheck the wiring, preferably someone with radio, TV or amateur experience.

2. If neither of the tubes lights up, check all of the wiring associated with pins 3 and 4 of V-1, and 1 and 6 of V-2. If one of the tubes fails to light, and you are certain the wiring is correct, the tube is defective. Replace it with one of the same type.

3. Recheck switches S-1 and S-2 very carefully.

4. Check the voltages and resistances using the following tables:

TRANSFORMER VOLTAGE CHART

All Voltages are AC RMS.

From	To	AC RMS V
Green	Green	6.3
Yellow-Green	Yellow	60
Red-Green	Red	500

TUBE VOLTAGE CHART

All measurements made with BALANCE control fully clockwise, AC OFF-R/C-LEAKAGE switch at R×1, and POWER FACTOR control at PAPER-MICA.

All voltages taken with a 20,000 ohms/volt VOM connected from tube pin to chassis.

TUBE	PIN						
	1	2	3	4	5	6	7
V-1 6X4	–520	0	0	0	0	–520	+170
V-2 6E5	0	+100	–.5	+170	0	0	

TUBE RESISTANCE CHART

All controls set as stated in Voltage Chart.

All measurements made from tube pin to chassis.

K = 1,000 ohms; M = 1,000,000 ohms; NC = No Connection; Inf = Infinity.

TUBE	PIN						
	1	2	3	4	5	6	7
V-1 6X4	80K	NC	Inf	Inf	NC	80K	65K
V-2 6E5	Inf	1.8M	10M	65K	0	Inf	

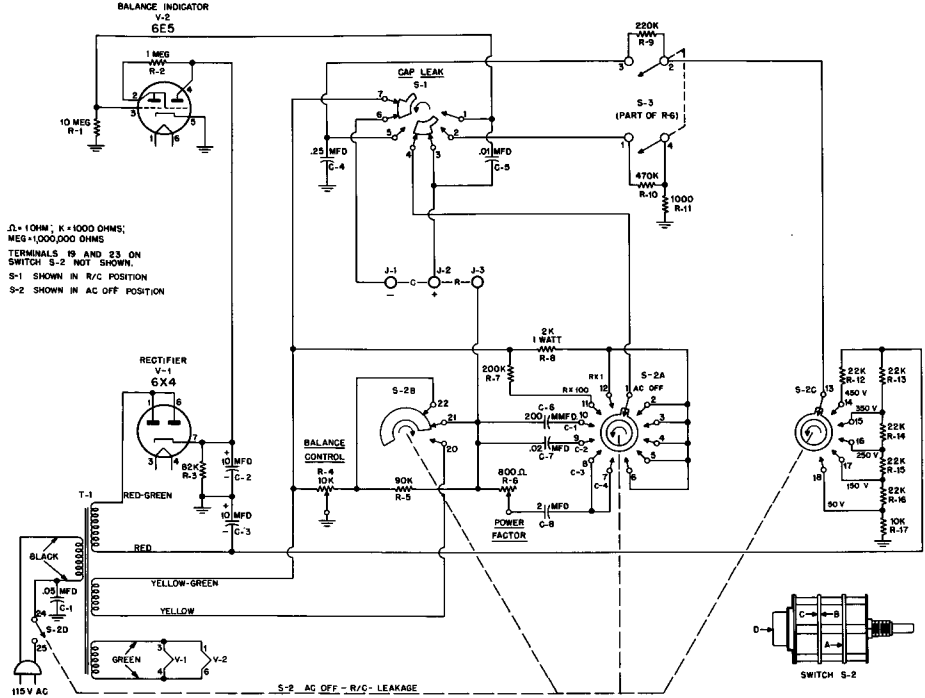


FIGURE 16. SCHEMATIC DIAGRAM

THE KNIGHT R/C TESTER PARTS LIST

Symbol Number	Description	Part No.
C-1	Capacitor, .05 MFD 400 V, paper	245055
C-2	Capacitor, 10 MFD 500 V, electrolytic	206100
C-3	Capacitor, 10 MFD 500 V, electrolytic	206100
C-4	Capacitor, .25 MFD 400 V, paper	245255
C-5	Capacitor, .01 MFD 600 V, GMV ceramic disc	276015
C-6	Capacitor, 206 MMFD 400 V, ±3%, silver mica	295001
C-7	Capacitor, .02 MFD 400 V, ±5%, paper	295002
C-8	Capacitor, 2 MFD 200 V (60 VAC), ±5%, paper	292001
J-1	Binding post, black	533002
J-2	Binding post, red	533001
J-3	Binding post, black	533002

Note: When ordering resistors, give complete description and part number.

R-1	Resistor, 10 Megohms, ½ watt	301106
R-2	Resistor, 1 Megohm, ½ watt	301105
R-3	Resistor, 82K ohms, 1 watt	304823
R-4	**BALANCE CONTROL** potentiometer, 10K ohms wire-wound, linear taper, 2 watts	402102
R-5	Resistor, 90K ohms, ½ watt, ±1%	349002
R-6	**POWER FACTOR** potentiometer, 300 ohms, wire-wound, linear taper, 4 watts, with DPST switch (S-3)	402106
R-7	Resistor, 200K ohm, ½ watt, ±1%	342003
R-8	Resistor, 2K ohms, 1 watt, ±1%	353001
R-9	Resistor, 220K ohms, ½ watt	300224
R-10	Resistor, 470K ohms, ½ watt	300474
R-11	Resistor, 1K ohm, ½ watt	301102
R-12	Resistor, 22K ohms, ½ watt	301223
R-13	Resistor, 22K ohms, ½ watt	301223
R-14	Resistor, 22K ohms, ½ watt	301223
R-15	Resistor, 22K ohms, ½ watt	301223
R-16	Resistor, 22K ohms, ½ watt	301223
R-17	Resistor, 10K ohms, ½ watt	300106
S-1	**R/C-LEAKAGE** spring-return single-wafer rotary switch	432102
S-2	**AC OFF-R/C-LEAKAGE** double-wafer rotary switch	433301
T-1	Power transformer	101401

Symbol Number	Description	Part No.
TS-1	5-terminal strip	440502
TS-2	3-terminal strip	440301
TS-3	3-terminal strip	440301
V-1	6X4 tube	610038
V-2	6E5 tube	610017

Quantity	Description	Part No.
1	Cabinet	700009
1	Chassis	461304
2	Clip, alligator	530006
1	Cord, line, with plug	802001
1	Magic eye assembly	040012
	Consists of:	
1	Bracket	470030
1	Escutcheon	720000
1	Eye frame	476001
1	Thumb nut	573440
2	Grommet, ¾"	830200
2	Grommet, ½"	830002
1	Handle Assembly	040008
	Consists of:	
1	Handle	470149
2	Cotterless	552000
2	Spring	470040
4	Washer	580901
1	Insulator, black rubber clip	880004
1	Insulator, red rubber clip	880003
3	Knob, 1"	700100
1	Knob, 2"	760401
5	Lug, solder	553002
1	Mansal, instruction	750068
6	Nut, 6-32 x ¼"	570340
3	Nut, 8-32 x ¼"	570440
8	Nut, ¾-32 x ½"	570840

Quantity	Description	Part No.
1	Panel, front, screened	462305
1	Plug, black banana	502114
1	Plug, red banana	502113
1	Pointer, clear plastic	870010
1	Resistor, calibrating, 200K ohms, ±1%	342003
6	Screw, 6-32 x ¼" BH	560342
8	Screw, #4 x ¼" SM	562202
2	Screw, #6 x ½" SM	562396
1	Socket, 6-pin	501160
1	Socket, 7-pin miniature	501070
30"	Solder, rosin-core	980001
5	Spaghetti	812061
3	Washer, extruded fiber #8	591401
9	Washer, flat fiber, #8	590400
4	Washer, lock, internal tooth	582760
4"	Wire, #20 Bare	806006
48"	Wire, black test lead	804019
48"	Wire, red test lead	804020

Wire, #20 insulated, ends stripped

1 ea.	2" red	801002
4 ea.	3" orange	801003
2 ea.	4" yellow	801004
3 ea.	5" green	801005
2 ea.	6" blue	801030
6 ea.	7" violet	801007
1 ea.	8" gray	801008
1 ea.	9" white	801600
1 ea.	10" brown	801010
1 ea.	11" brown-white	801011
2 ea.	12" red-white	801012

TOOLS YOU MAY NEED

Stock No.	Description	Price*
46N852	Soldering pencil	$5.20
50N132	Long-nose pliers	1.54
50N133	Diagonal Cutters	1.34
45N703	6" Screwdriver	.72

*** All prices subject to change without notice.**

ALLIED'S SERVICE FACILITIES

In the event that the kit still does not operate properly, we recommend the following:

Please write our Kit Department with full details and include the stock number and the date of purchase of the kit. We may be able to determine any wiring error or replace a component which may be at fault.

This wired KNIGHT kit may be returned for inspection within 1 year after purchase for a special service charge of $3.00. Parts within the standard RETMA 90-day warranty period will be replaced without charge for the parts. An additional charge will be made for parts damaged in construction or because of a wiring error, or for parts which are beyond the 90-day warranty period. After the one year period, service charges, plus cost of parts, are based on the length of time required to repair the unit.

PLEASE NOTE: KITS WIRED WITH ACID CORE SOLDER OR ACID FLUX ARE NOT ELIGIBLE FOR REPAIR OR SERVICE AND WOULD HAVE TO BE RETURNED NOT REPAIRED AT YOUR EXPENSE.

Allied's facilities primarily provide an inspection and trouble-shooting service. Kits not completed, which require extensive work, will be returned collect with a letter of explanation.

If you must return this kit, pack it well. Use the original packing carton and use cushioning material around the front panel. Send the kit prepaid and insured. We will return the repaired kit to you C.O.D. as soon as repairs are completed. If you wish to save C.O.D. fees, your advance remittance may be enclosed for standard repair charges plus transportation costs. Any excess remittance will be refunded.

ALLIED'S GUARANTEE ON KNIGHT KITS

The designs and components selected for KNIGHT kits represent over a quarter of a century of experience in kit development. KNIGHT kits are easy to assemble even for the beginner. Instructions are complete, panels are drilled, the chassis is punched and formed, and every last part is included as listed.

Allied extends these firm guarantees on KNIGHT kits:

We guarantee that the circuits on all KNIGHT kits have been carefully engineered and tested.

We guarantee that only high-quality components are supplied. All parts are covered by the standard RETMA 90-day warranty. Any faulty components will be replaced prepaid and without charge if reported to us within the warranty period. We reserve the right to request the return of defective parts.

If your kit was shipped by parcel post and is received in a damaged condition, please write us at once describing the state in which the shipment was received. If your kit was part of a Railway Express shipment that was damaged in transit, please notify the Railway Express agent at once and then write us.

The efficiently engineered KNIGHT kits are moderately priced. When you buy a KNIGHT kit you get the best in design, quality, and value. Recommend KNIGHT kits to your friends.